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By-Sell, G. Roger; And Others

Appendix W. Cost Analysis in Teacher Education Programs.

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This paper is an introduction to the basic cost-related tools available to management for planning, evaluating, and organizing resources for the purpose of achieving objectives within a teacher education preparation program. Three tools are presented in separate sections. Part I on the cost accounting tool for identifying, categorizing, and calculating resources needed to support the operations of the program includes discussion of cost estimating relationships, sources of cost data, a cost data bank, estimating techniques, and organization of system costs. Part II on the cost-effectiveness tool for maximizing system effectiveness while minimizing costs includes discussion of the systems approach, features of the cost-effectiveness system, and the cost-effectiveness concept (with a diagram). Part III on the cost-benefit tool, a means of comparing program costs and program benefits, discusses the individual and societal cost-benefit ratios. Included is a 24-item reference list. This document and SP 002 155-SP 002 180 comprise the appendixes for the ComField Model Teacher Education Program Specifications in SP 002 154. (JS)

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APPENDIX W--COST ANALYSIS IN TEACHER EDUCATION PROGRAMS

G. Roger Sell

Dale G. Hamreus

Harold McAbee

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Submitted for a Consortium of
Institutions and Agencies by the
Northwest Regional Educational Laboratory
400 Lindsay Building
710 S. W. Second Avenue
Portland, Oregon 97204

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COST ANALYSIS IN TEACHER EDUCATION PROGRAMS

G. Roger Sell
Dale G. Hamreus
Harold McAbee
(Consultants)

Management personnel in teacher preparation programs are simultaneously experiencing an exciting, but potentially overwhelming, thrust to improve the effectiveness of teachers. Some of the reality demands upon management include: the preparation of competent teachers who can maximize the potentialities and opportunities of our nation's youth, the need to incorporate advances in instructional technology into the curriculum for the improvement of instruction, the acquisition or training of an instructional staff qualified to assist in the preparation of competent teachers, the influx of student population while attempting to individualize learning experiences and attend to individual needs, and linking the college experiences more closely with those demanded in the school setting.

All of these thrusts, or trends, have complicated the management process by making decisions more complex and critical. but also more opportunous. This all says that more effective and efficient decisions are called for in appropriating the available resources needed to support teacher preparation programs.

This paper will attempt to present the cost-related tools available to management for planning, evaluating, and organizing resources for the purpose of achieving objectives within a teacher preparation program. For lack of a better understanding of the intricacies of program management and the professional costing functions associated with it, the paper's basic utility is an introduction to the concepts involved. However, an honest attempt is made to present the cost-related functions in a framework which will provide the readers with an applicable base of information to direct their further inquiries and efforts surrounding the cost functions presented.

The specific focus of this presentation is on the tools of cost accounting, cost-effectiveness, and cost-benefit as they related to resource utilization in a teacher preparation program.

PART I - THE COST ACCOUNTING TOOL

One of the processes involved in analyzing program costs is the identification, categorization, and calculation of resources needed to support the operations of the program. This may be identified as the cost accounting function. (NOTE: The traditional accounting function employed in recording program costs normally is limited to identifying and categorizing resources, whereas cost accounting, in addition to the above operations, includes the calculation of costs expended or to be expended). Seen from another point of view, cost accounting is a first level analysis of the resources required to support a program at a given level of capability.

In operation, the cost accounting component relates the staffing, plant, equipment, materials, and service costs to the various elements within the program. These costs may be categorized into two classes: nonrecurring and recurring.

The nonrecurring costs involve such areas as research and development activities and the initial investment to implement the products of those activities. Among the list of research and development costs might be preliminary research and design studies, design and development of subsystems, or system evaluation costs. The initial investment might include training, equipment, facility, of installation expenditures.

The recurring costs are composed of annual operations needed to maintain and evaluate a program. The annual operation expenses will include such areas as salary, allowance, replacement of equipment, maintenance of equipment, replacement training, or transportation costs.

The Rand Corporation has utilized a method of cost accounting with three classes within their chart of accounts: (1) research and development costs include all costs necessary to bring a system into readiness for operation (nonrecurring); (2) investment costs include all costs required in the process of phasing a system into operation, e.g., facility, equipment, or training costs (nonrecurring); and, (3) annual operating costs include all costs necessary to the operation of the system, e.g., salary and allowances, training, and maintenance costs (recurring). (Petruschell & Chester, 1963)

Figure 1 relates the above three classes to the incremental, time-phased resource requirements of a programmatic effort, i.e., a system. An identification must be made of the total cost of a program element over its entire life, or life cycle, including the cost of supporting activities. This is particularly critical in the planning phase of system development.

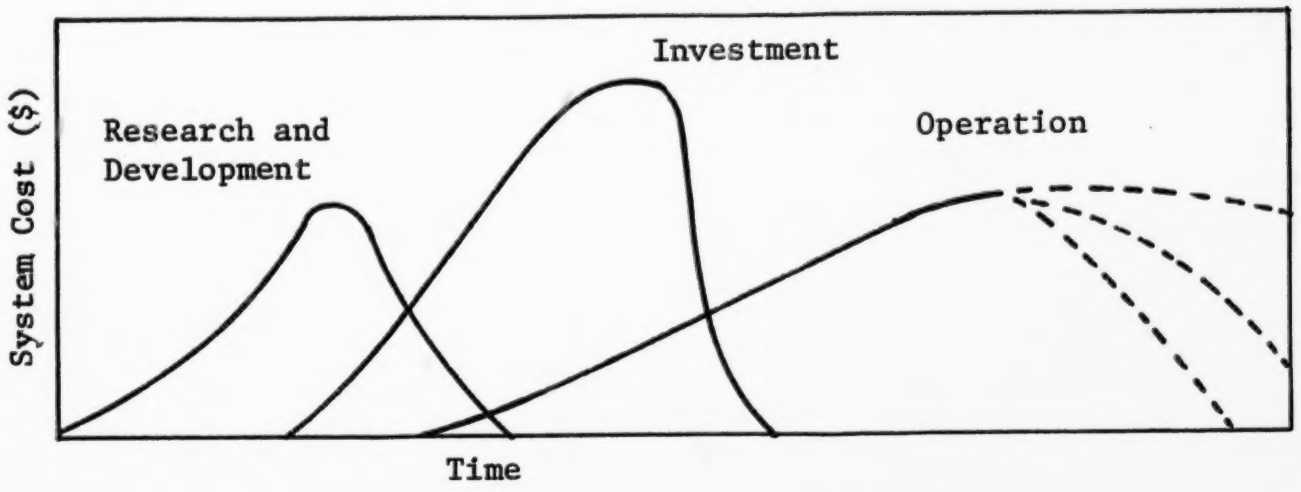


Figure 1: Life cycle costs: Illustration of system "Life Cycle" plotted against time. (Adapted from McCullough, p.18)

Also note in Figure 1: research and development costs are essentially one-time costs and are a function of the nature of the system; investment costs are a function of the number of units planned for the system and are very nearly one-time costs; and, operating costs depend on both the number of units in the program and the length of time they are to be operated, supported, and maintained. These costs in combination, then, reflect the life cycle approach to cost analysis which can be generalized to fit any size system or subsystem.

To summarize, the product of one phase of cost accounting is a base line alignment of costs accrued as they relate to discriminate users within a program and the cost of operating the total program. Upon request, costs generated by system resource requirements can be abstracted, compared, or contrasted to provide an inter-system analyses. Therefore, the results of this phase can be seen as accounting for operational costs of any and all parts of a program, making analyses, and providing cost displays for the users.

Cost Estimating Relationships

Another aspect of cost accounting as a management tool involves the cost estimating relationships which can be made available for alternative systems. Such a function is essential in the planning and designing stages of system development.

Two interdependent decisions must be made in the process of cost estimating: (1) what sources to tap for the data required to make cost estimates, and (2) what methods or techniques to use to estimate item or total system costs.

Sources of Cost Data

There are several classes of cost data sources which can supply cost-related information needed in making cost judgments:

1. The assumptions or restraints which govern the cost estimate may come from fiscal agents or other experts. These should be made explicit for the benefit of the user, i.e., management.

2. A systems description and operational source will indicate the intended operations and actual operations of the system. This allows the cost analyst to relate the cost estimates to the design and operation of the system.

3. System sources outside the program may offer cost data on single systems considered by the program or costs on programs based upon general experience.

A Cost Data Bank

To achieve maximum efficiency and effectiveness in designing cost estimates, the utilization of a cost data bank (which may be viewed as a part of the information management system) is highly recommended. Such a data bank could be centrally located for handling major empirical functions associated with costing demands. Its objectives might include: (1) a systematic collection, storage, and updating of specified types of cost data; (2) an efficient method for entry of cost-related data into the bank; (3) a systematic method of evaluation, validation and categorization of the data; and (4) a quick means of retrieval for ultimate use.

Some of the initial implementation and operation costs of a program will be difficult to estimate based upon the "newness" of the system. Other cost data may be obsolete or difficult to acquire. In any case,the initial efforts of the cost accounting area should be directed to a system design for accommodating the cost analysis functions of the operational program.

Once the cost data has been collected and systematized, an analysis and evaluation stage follows. Here the task is how to combine and synthesize data sources and estimating techniques.

Estimating Techniques

Five basic cost estimating techniques have been identified and utilized in various costing systems. The attempt is to relate a class of expenditures in some way so that a cost estimate on a system or a proposal can be made.

1. Cost per unit: identifies an item or items within a system as a specific type and in a specific quantity.

2. Cost-to-cost relationship: estimates cost as a function (percentage) of some other items cost.

3. Non-cost-to-cost relationship: estimates an items cost as a generalized average relationship.

4. Specific analogies: estimate item cost based upon some analogous relationship to a prior similar system.

5. Expert opinion in some specialty: provides the cost analyst with an estimate of the cost of a specific item or interrelated items.

The Organization of System Costs

A final comment on the cost accounting function. From this point of view the organization of costs to get at subsystem costs or total system costs may be through a unit (divisional structure) or functional (programmatic structure) basis of subdivision. Both of these organizational schemes are viable in cost accounting systems. What is most important is that cost-related information be translated to management personnel in a framework representing that of system operations.

PART II - THE COST-EFFECTIVENESS TOOL

Those in the role of managers, like all economic men, must make decisions regarding unlimited opportunities within a limited amount of resources. The users (implementers) of a teacher education program may have an open resource base or a fixed resource base. In either case, the objective is to maximize system effectiveness and minimize system costs. With an open resource base, the emphasis is on choosing a system or systems which achieve the objectives at the least cost. With an open resource base, e.g.,

fixed budget or limited acquisition of external resources, the specific system which is most effective in achieving program objectives is most preferred, assuming that an equivalent value of resources represents each alternative system under question.

The Systems Approach and Cost-Effectiveness

The systems approach is a methodology by which a program becomes descriptively organized by explicated objectives. It is aimed at assisting managers in decision making, planning, and designing interrelated functions based upon a comparison of alternative system proposals to discover which is preferred for the achievement of a program's objectives. The systems approach emphasizes the continual assessment of performance, maintenance of sensitivity to performance criteria, and provision for the adaptation of performance in order that the objectives can be achieved.

The quantitative outputs of the systems approach are cost-effectiveness indexes. They attempt to offer management another criterion in making program decisions regarding objectives, performance, and resources.

Features of a Cost-Effectiveness System

Some of the more important features of a cost-effectiveness system as noted by McCollough are end-product orientation, extended time horizon, and incremental costing.

End-product orientation: This feature reflects a systems approach where diverse resources can be identified and associated with the end-product. The immediate problem is to systematically identify all costs associated with the selection of a particular instructional system or program operation. The cost of the system or program operation should reflect the total resource impace of the decision relating to those systems.

Extended time horizon: Cost-effectiveness can also be used for long-range planning. Development decisions may require from three to five years before a complex instructional system can be brought into being. In order for a costing function to be effective, the span of time covered in the cost analysis must be sufficiently long to cover such lead time. Also, it should cover the full period of the instructional system operation before it reaches obselescence and the end of its benefits.

Incremental costing: Analysis must always move from some base that represents the existing capability and existing resources. The problem is to determine how many additional resources are needed to acquire some specific additional capability. It is the incremental costs that are relevant. In measuring incremental costs, care must be taken to exclude costs expended in the past (sunk costs). These costs are not relevant to determining future costs to acquire a future capability. However, to specify which costs have been excluded may serve as a valuable reference.

The Cost Concept

The cost accounting function, already discussed, is aimed at providing management with the monetary value or estimated value of the resources expended in the program operations. Cost, from this point of view, is an incremental, time-phased expenditure supportive of program operations. The need for resources does not reach a given point and then just stop; they continue for the life of the system. Additionally, resource demands take place in real time. For management, the outlay of resources exhausts support, always having a negative effect on the operations.

The Effectiveness Concept

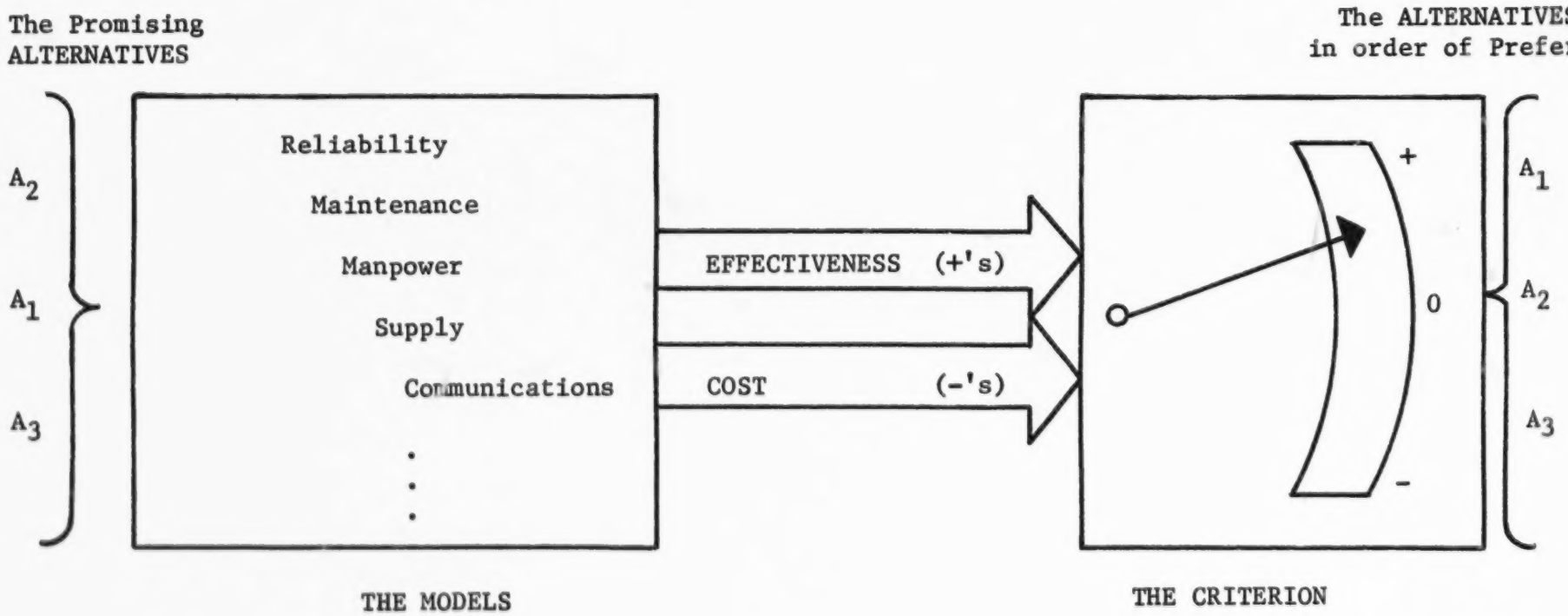
Resources in various combinations provide management with support for achieving program objectives. The alternatives may represent various systems, methods, or techniques capable of attaining the specified objectives. However, some combinations of resources provide a more effective array than others. Therefore, judgments must be made regarding alternatives and their estimated program effectiveness.

The Cost-Effectiveness Concept

The objectives of a program are usually stated in such terms which will not close out possible resource mixes to accomplish them. However, the process of supporting the more generic aims with specific objectives is a critical operation. Not only must the specific objectives enable the generic aims to be accomplished, but they must lend themselves to some form of measurement, i.e., evaluation. It is this quantification of objectives which serves as the basis for determining the comparative effectiveness and cost of competing systems or resource alignments.

Figure 2 represents the relationships between elements in a cost-effectiveness analysis. The alternatives are viable means of accomplishing the specified objectives. The models are representations of relationships among objectives, alternatives, resources,

Figure 2. The Cost-Effectiveness Concept (Adapted from Quade, p. 9)



and environment. They are used as predictors and to demonstrate the significant costs of the system. The criterion is a guide for choosing the preferred alternative. Again, the attempt is to maximize system effectiveness and reduce system cost.

PART III - THE COST-BENEFIT TOOL

A teacher preparation program may be perceived as having its primary goal the preparation of competent (effective) teachers who can maximize the potentialities and opportunities of school pupils. At this broad level, the appropriate question seems to be: What are the optimum resource mixes available which can accomplish this goal in an instructional program? Or, placed in another context: What are the costs of a teacher preparation program as they relate to the benefits derived from the program by teachers, pupils, and the public?

Benefits from a teacher preparation program are likely to accrue over time in a particular pattern; however, the costs of such a program will probably have a different time pattern. Therefore, to make a comparison of costs and benefits, it is necessary to develop a methodology which will permit the summarization of costs and benefits over time. By discounting future costs and benefits, one arrives at a present commensurability of costs and benefits. Therefore, the ratio of the present value of future costs to the present value of future benefits is termed the cost-benefit ratio. (Davie, 1965) As a rule of thumb, unless the cost-benefit ratio for a particular program is less than one, that program should doubtfully be undertaken. However, this is assuming that all costs and benefits are quantifiable, i.e., commensurable. Usually, the lower the cost-benefit ratio the more desirable the program.

In many cases, however, an educational program may have extensive intangible benefits which need to be included in the consideration of adoption for the program, but cannot be included in the formal quantification analysis. Some such intangibles might include judgments made with reference to the appropriate behaviors the program attempts to develop in teachers and pupils, or the impact of the teacher and pupil on the school system and the public as a result of developing specified capabilities engendered, directly or indirectly, by the program. These types of judgments seem almost beyond any qualification attempts, but the point is that they need to be identified and evaluated within the decision making context. Therefore, if a teacher preparation program has an excessive amount of intangible benefits attributed to it, another cost benefit approach

may be advised: the benefits may be treated as an unknown (unquantifiable) in the equation while the estimated costs of the program are known. The task, then, is to assess the projected benefits in terms of future return to the individual or society as compared with the program costs. This also opens the door to consider several candidate programs for development/implementation with a provision for some systematic analysis of each one.

Individuals Cost-Benefit Ratio

To involve oneself in a teacher education program for the purposes of becoming a competent teacher involves a fair level of sacrifice. The individual sacrifices out-of-pocket costs needed for tuition/fees, transportation, housing/food, and other items associated with student life. In addition, he must forego the income he could have received had he been employed rather than in school. However, as a result of being in the program, an individual teacher may increase his life-time income, improve his standard of living and/or his level of status, increase his personal and/or family security. In addition to these considerations are some "intangible" items which need to be brought to bear in the process. The intellectual/emotional development of the individual may be considered a quite substantial area of benefits derived from the program and should be placed in some relationship to the costs. However, again, the rule of thumb says that the benefits should outweigh the costs to make the individual's participation in the program desirable.

Societal Cost-Benefit Ratio

From society's point of view, the costs associated with the program include such out-of-pocket items as subsidizing the operation of the program through college or university monies granted or appropriated. The opportunity costs, in the societal context, are quite difficult to account for (in a quantitative aspect) because of the supply/demand concept operating within the economy, i.e., given an open manpower base, the supply of prospective teachers is channeled to the demand areas or to that sector of the economy in most need of similar personnel. Benefits to society might be derived from a teacher preparation program by helping reduce unemployment, increasing intake of taxes based upon increased earning power, and reducing potential welfare recipients. Some "intangible" benefits derived from the program might include community growth, development, and improvement, the well-being of the individual in society, or a contribution to community leadership.

In summary, the primary objective of cost-benefit studies is to provide some systematic (quantifiable, if possible) approach to the comparison of program costs and program benefits. Although some of the benefit areas discussed border on "value" judgments, measurement tools are becoming increasingly available which can offer a better understanding of what those "intangibles" might be and act like.

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